

CONTRIBUTION TO THE STUDY OF THE ACHILLES-JERK AND THE FRONT-TAP.¹

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The recent activity in the study of the reflex mechanism has brought to light a great number of movements involving a large part of the musculature. The importance of each new reflex is urged, the character of each is minutely discussed, and the priority of observation disputed. It would not be right at present to deny the importance of any of them, for we can all remember the time when we held, and taught, that the plantar reflex with its variations was of no import practically, and was never likely to take a place among the major tests in diagnosis. This reflex now stands perhaps at the head of the list from which it was formerly excluded. Whatever prominence these new reflexes may attain in the future, two phenomena, though long recognized, seem not yet to have received quite the attention they deserve, namely, the Achilles-jerk and the front-tap. The Achilles-jerk has been extensively studied, but has not taken the place it should, at least on this side of the water, as a routine test of equal importance with the knee-jerk; the front-tap has not even been extensively studied.

The object of this paper is to emphasize the importance of the one and to contribute toward the study of the other.

THE ACHILLES-JERK.

The result of our study of this (so-called) reflex coincides with those of most observers. We have found it in health equally constant with the knee-jerk as, with the exception of Strasburger, have other observers. (Bramwell, Sarbo, Cestan, Schoenborn, Kollarits.) We have also found it more uniform in excursion and more easily elicited than the knee-jerk. We have found it disappearing early in tabes, and regard its loss quite as typical of this disease, as the absence of knee-jerk. These results are in accord with those of other observers (Babinski, Mills, Collins, Bramwell, Seyer, Goldflam, Trumporszki). We have found it increased as a rule in hypertonic, and decreased in hypotonic conditions.

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We have employed the various methods suggested for testing this reflex, and find little to choose between having the patient kneel in a chair, and having him sit in a chair with the knee bent to a right angle, or to an angle slightly more acute. If the patient is in the latter position the heel can be seen to rise if the reflex is active, but it is best to place the hand on the calf and to judge its activity by the muscular contraction rather than by the movement of the foot. For purposes of demonstration the kneeling posture is preferable. It is better to have the patient kneel on a cushion or a shawl rather than on a hard wood seat, for many persons find the latter so uncomfortable as instinctively to put the muscles under a tension which interferes with eliciting the reflex. Some find it difficult to relax in this situation in any event, and for such the sitting, or even, as Sarbo suggests, the recumbent posture may be tried to advantage. Muscular tension on the part of the patient interferes less, however, with the Achilles than with the knee-jerk, an additional argument in favor of its routine use. For patients in bed we use the methods of Strasburger and Ziehen (with knee straight and flexed respectively), with such modifications as the circumstances demand.

In the majority of cases the reflex can be obtained without removing the shoes, but this precaution should never be neglected in doubtful cases. In some instances it is best obtained by tapping the middle of the tendon, say two inches above the os calcis, in others by tapping the tendon close to its insertion, and sometimes better on one side. Less technical skill and less practice are required to obtain this reflex than to obtain the knee-jerk. It follows that as this test comes into general use, the records of those not specially skilled will be more reliable than they are at present regarding the knee-jerk.

The Achilles-jerk in health. We have examined 500 persons of both sexes varying in age from five to eighty-two years, either in apparently perfect health or suffering from some trouble independent of the nervous system, and have failed to elicit this reflex on both sides in only one instance, on one side in four. In these five instances the knee-jerk was present. The knee-jerk was present in every case; in two it required reinforcement on one side, but was easily elicited on the other, and in eleven the knee-jerk was so feeble as to require repeated tests with reinforce-

ment; in these thirteen instances the Achilles-jerk was easily demonstrated. In a single case, an active knee-jerk was combined with an Achilles-jerk so feeble as to be elicited with great difficulty.

One of the cases of diminution of patellar and presence of Achilles-reflex was a man of eighty-two; in another, a man of forty-nine, diphtheritic paralysis had occurred at the age of twenty-five, before which the knee-jerk was present and active. The latter history led to an inquiry as to the previous history of the cases of unilateral feebleness of knee-jerk. It appeared that one of these individuals, a healthy man of twenty-eight, had in infancy a severe attack of diphtheria not followed by paralysis; the other gave a history of repeated and severe sore throats.

The question seems pertinent then, *whether prior toxic influence may not sometimes cause the enfeebled, or even absent, knee-jerk occasionally found in health.* If this was the case in the two instances cited, these observations only serve further to illustrate the hardness of the Achilles-jerk, since this phenomenon was active in both.²

Though the excursion and activity of the Achilles-jerk in our cases varied to a certain extent in different individuals, it was constantly noted that these variations were appreciably less than those of the knee-jerk. In an occasional case it has been somewhat stronger on one side, as has the knee-jerk.

The result of these observations, coupled with those of others, led to the conclusion that the routine test of the Achilles is of equal importance with that of the patellar reflex in eliminative diagnosis and in the establishment of neural health.

The Achilles-jerk in disease. In thirty-five cases of tabes dorsalis we have found none with preservation of this reflex except one case in which the symptoms were unilateral and all reflexes were normal on one side. We have found two cases with

²It is worthy of note in this connection that Pfaundler found the knee-jerks absent in 27.5 per cent of 200 cases of croupous pneumonia in children.

Dr. McCollom, who, as the head of the contagious service at the Boston City Hospital, has seen some 10,000 cases of diphtheria, states in answer to an inquiry that the knee-jerk is wanting in the majority of serious cases of this disease. He questions whether cases of so-called croupous pneumonia are not frequently cases of diphtheria of the lungs, the physical signs of the two affections being identical.

present knee-jerk on both sides and with absent Achilles-jerk on both sides.

These observations tend to corroborate the opinion of most other observers, that the Achilles-jerk is, as a rule, the earlier to disappear in tabes.³ This is a most important practical point in diagnosis. Suppose, for example, we are consulted by a person with feeble or absent knee-jerk. If we find his Achilles-jerk present we may reassure him with considerable confidence as to any suggestion of tabes in his absent knee-jerk. If the Achilles-jerk is absent we cannot so reassure him, though it would be going too far to say that this combination establishes tabes, for it may also be found in other hypotonic conditions.

In other directions our data while too few to be used alone for statistical purposes, may be suggestive. We have found this reflex present, generally active, in thirty-eight cases of epilepsy usually accompanied by active knee-jerk; it was diminished in only one case, a case in which the knee-jerk was present. All these patients were taking bromides, generally not less than 60 grains daily.

This finding is in accord with the statement of Clark, who finds the knee-jerk generally active in this disease except during the attack, when it disappears. He regards this activity as an exhaustion phenomenon. As far as we have been able to discover, no other statement has been made regarding the reflexes in this disease, excepting during and immediately following the attack. In exophthalmic goiter we have found the Achilles-reflex present, generally active, in eight cases, wanting in none. In neurasthenia, hysteria and other neuroses we have found this reflex always present, but less active and disagreeable than the knee-jerk. In fourteen cases of paresis both Achilles-jerks and knee-jerks were increased in seven, decreased in two, average in five. The knee-jerk and Achilles-jerk were exaggerated in twenty-four cases of hypertonic paralysis including hemiplegia, wanting in three old cases of hemiplegia with contracture. In hypotonic conditions the Achilles-jerk has always been absent. The Achilles-jerk was wanting on the side of sciatic pain in one case of osteoarthritis of the spine.

³Bramwell's results varied slightly from those of other observers in that although he found loss of both reflexes in 48 cases out of 52 examined, in the other four the loss was equally divided between the two reflexes.

THE FRONT-TAP.

The study of this reflex (named by Gowers) seems to have been meager. Search through the literature reveals the fact that neither its physiology nor its diagnostic significance has received attention. The method of testing the front-tap consists in smartly tapping the tibialis anticus with a Taylor rubber hammer (less advantageously by the finger), the examiner meantime flexing the foot dorsally, and holding it in this position, the ankle resting on the knee of the examiner or on the edge of a stool (preferably slightly lower than the chair upon which the patient is seated, or with the leg extended if the patient is in bed). The reflex consists in plantar flexion of the foot.

Gowers suggests that the stimulus may pass through to the flexors of the calf, and he has called attention to the fact that the vibration may be felt in the gastrocnemius. This explanation is weakened by his observation that the phenomenon is less readily produced, if at all, by tapping the shin-bone. As regards the significance of the front-tap, Gowers speaks of it as occurring *when the reflex phenomena are in excess*, and again as a very delicate test of increased irritability.

The explanation offered by Gowers regarding its production does not seem quite satisfactory, and while we are not sure that we can better it, we would suggest that it may be allied in a way to the ankle-clonus, though not of its sinister import. May it not be the case that in taking the front-tap the position of the foot in extreme dorsal flexion (and this generally is the most favorable position) puts the tendo-Achillis under such tension that the trifling tendency for the tibialis anticus to contract and thus still further dorsally flex the foot is enough to stimulate, or tend to stimulate, the gastrocnemius into a contraction? An observation occasionally made tends to confirm this view. Namely, in a rare instance evident dorsal flexion of the foot precedes plantar flexion. In fact, sometimes the only movement is an upward one. In many, perhaps in most, cases in which the front-tap phenomenon is present, there is visible contraction of the tibialis anticus.

Whatever the mechanism of this phenomenon may be, its significance seems to have been not completely interpreted, probably because no systematic test has been made of its presence or absence in health.

The front-tap in health. We have made this test in 500 persons, all of whom were either in apparent health or were subjects of disorders having no recognized influence on the central nervous system. Of these individuals 200 were males and 300 females. The ages varied from six to eighty-two.

The result of this examination showed the front-tap present in 75 males, or 37.5 per cent, and in 124 females, or 41.3 per cent. In many of these cases it was extremely lively. In an occasional instance the difference between the two sides was sufficiently marked to cause the phenomenon to seem absent on one side at the first test while present on the other, but in such cases more searching examination generally established its presence on the side first tested.

It is possible that in a larger number of these cases the reflex could have been teased out by persistent effort, but whether this is so or not the fact seems established that the *mere presence of the front-tap, even in active form, does not militate against perfect health.*

In order that the test might be made in one series from which the question of ill health could be practically eliminated, 59 picked young women taking the course in the Boston Normal School of Gymnastics were tested through the kindness of the director, Miss Amy Morris Homans.

Out of the 59 cases the front-tap was present in 15, that is, in about 25 per cent.

This series is mentioned as demonstrating the presence of the front-tap in health. The number of cases is too few to warrant drawing a comparison between the athletic and the average individual in respect to the front-tap, but further elaboration of this comparison in the matter of all reflexes might prove of interest.

We have not found the position of the knee, straight or flexed, of importance in eliciting the front-tap. One precaution should be mentioned, however, in this connection, namely, to avoid pain in patients with sciatica, osteoarthritis of the spine, and allied conditions, it is well to have the foot much lower than the knee, or else to make the test with the patient in the recumbent posture. In very rare instances healthy persons complain of slight discomfort if the leg is placed as pictured by Gowers, a fact which has led us to allow the knee of the person examined to be slightly flexed.

The front-tap in disease. Our observations tend to show that this test, though of less positive value in diagnosis than the Achilles-jerk, may be of material aid in connection with other signs and symptoms.

In neurasthenia, hysteria and other neuroses we have found the proportion of front-taps greater than in health, namely in 59 out of 80 cases (70.4 per cent); namely, hysteria, present in 14, absent in 6; neurasthenia, present in 31, absent in 9; other neuroses, present in 14, absent in 6. In 8 cases of goiter it was present in 7 (87.5 per cent). In an epileptic attack the front-tap disappears with the knee-jerk. In 100 cases of epilepsy the front-tap was present in 75 (in several only on one side), absent in 20, impossible to test on account of position of limbs and mental condition in 5.

We have in no case found the front-tap present in tabes or other hypotonic affections; in paresis we have found it present in 8 out of 14 cases. In other diseases involving hypertonic conditions, including hemiplegia, we have found it present, generally exaggerated, in 24 out of 28 cases. Three of the cases in which it was wanting were old hemiplegics with contracture and absence of other reflexes; one was a case of probable meningitis and encephalitis of infectious origin with absent knee-jerk and present ankle-clonus, a combination elucidated by Mills, the absent knee-jerk being due, perhaps, in this case, as in that of Mills, to neuromuscular infection, though autopsy could not be obtained to decide this question.

For opportunity to add to our statistics we are indebted to our colleagues in the Massachusetts General Hospital, to the staff of the Eye and Ear Infirmary, the State Hospital at Tewksbury, and the Long Island Hospital, also to Dr. Fuller of the Adams Nervine Asylum, and Dr. French of the State Hospital at Medfield.

From the numerous *instances illustrating the practical aid in diagnosis furnished by these reflexes* we will cite two only, both of general paralysis, one showing the hypertonic, the other the hypotonic variation in this disease.

Case I. A man forty-four years of age complained of numbness in the left side and of frequent epileptiform attacks of recent onset. Both the patient and his wife seemed inclined to attribute his condition, largely at least, to a blow received over the right

ear from an iron bar six months ago. There was brief unconsciousness, the patient being able to get up and go home. There were evidences pointing to exaggeration, for example, the extreme tenderness complained of at the point of injury seemed to disappear when his attention was distracted; the test for anesthesia also was inconclusive.

The knee-jerks and pupils were normal and there were no other definite signs elicited by physical examination until the *Achilles reflex* was tested; this was *absent on both sides*. Further examination of the mental condition showed inability to carry test sentences in mind or to repeat them correctly. The writing also showed evidence of mental deterioration. In keeping was the statement of his wife that there was marked change in disposition and that he was not to be depended upon for errands or other duties.

In this case the absence of Achilles reflex was the one sign which enabled us to diagnosticate organic disease (general paralysis) with a confidence which would hardly have been justified under the circumstances either from his mental exhibit or from the history.

Case II. A man of forty-four years of age, for some time under observation at the Massachusetts General Hospital, had been regarded as a case of early tabes notwithstanding the preservation of knee-jerks and Achilles reflex. The diagnosis was based on the characteristic pupils and other symptoms.

The routine test revealed an *active front-tap*. This led to a reconsideration of the diagnosis, and further examination demonstrated the mental condition characterizing the early stages of general paralysis.

CONCLUSIONS.

1. The Achilles-jerk is practically as constant in health as the knee-jerk. This reflex varies less in health than the knee-jerk in excursion and activity, and is the most easily elicited and uniform of all tendon reflexes.

2. The Achilles-jerk disappears, as a rule, early in tabes dorsalis, and its absence is as diagnostic of that disease as is loss of the knee-jerk. We have not seen a case far enough advanced to establish tabes with persistence of the Achilles-jerk, except one case in which both the knee-jerk and the Achilles-jerk were present on one side only. We have observed bilateral preservation of knee-jerk and loss of Achilles-jerk in two out of five cases of tabes.

3. Enfeeblement of knee-jerk in health on one side or both

may be due to prior toxic influence, as diphtheria. This may also be true of the Achilles-jerk, though in the one case in which it could be demonstrated of the knee-jerk, the Achilles-jerk was normal. Further observations on this point are desirable.

4. The front-tap is present (generally on both sides) in about 40 per cent of individuals in ordinary health; in some it is very active. It follows that its presence alone, even if active, does not establish disease, nor indicate excessive irritability of the nervous system.

5. In organic disease the front-tap is generally increased with the other reflexes in hypertonic, and decreased (generally wanting) in hypotonic states.

6. In the so-called functional disorders, hysteria, neurasthenia, and unclassified psychoses, we have found the front-tap present in 71 per cent of cases. In epilepsy we have found it present in 75 per cent of cases. The test may therefore here prove of aid in combination with other findings, though its mere presence or even activity is not of positive diagnostic value, nor does its absence negative the existence of neuropathic conditions.

7. Both these reflexes deserve to be placed upon the list of routine tests for purposes of diagnosis. This is particularly true of the Achilles reflex, which is of the greater positive diagnostic value.

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